Packing structure of granular systems

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We investigate the ballistic deposition of granular particles and agglomerates of particles using a modified Fischer-Bölsterli Algorithm [1]. In the case of the unconfined deposition of particles from a circular dropping area on a flat plate, a heap is formed. Very large heaps are found to contain three new geometrical characteristics not observed before: they may have two external angles of repose, an internal angle of repose, and four distinct packing fraction (density) regions. Such characteristics are shown to be directly correlated with the size of the dropping zone. In addition, we also describe how noise during the deposition affects the final heap structure [2].

The algorithm may be also applied to investigate the structural evolution of a nanopowder by repeated dispersion and settling which can lead to characteristic fractal substructures with robust statistical properties [3]. The agglomerate is cut into fragments of a characteristic size ℓ, which then are settling under gravity. Repeating this procedure converges to a loosely packed structure, the properties of which are investigated: (a) The final packing density is independent of the initialization, (b) the short-range correlation function is independent of the fragment size, and (c) the structure is fractal up to the fragmentation scale ℓ.

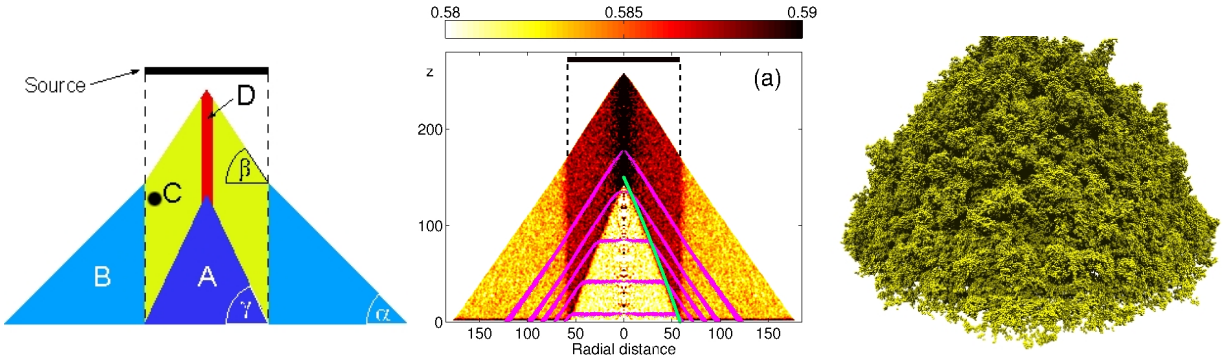

Figure 1: Large heaps from area sources reveal 4 zones of different density and 3 characteristic angles (left and middle). Fractal sediment of nano-particles (right)

References

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